Space Weather Technical Forecast

Issued on Friday, 02 August 2024 at 13:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Occasional M-flares expected, chance of X-flares and of exceeding S1/Minor Radiation Storm threshold. Potential further CME blows Days 1-2 (02-03 Aug), chance of G1-G2/Minor-Moderate Geomagnetic Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Moderate, with occasional M-class flares observed from across the disc, the strongest an M7.4 peaking at 02/0455UTC, from AR3768. A highly active disc with fifteen sunspot regions. AR3768, rotating over the southwestern limb, continues to be active providing the largest flare activity. AR3765, AR3766 and AR3767 persist as a cluster of spots in the southwest disc, with AR3765 and AR3767 in particular in very close proximity, to the point where the two regions are pushed together with the trailing and leading portions sharing a penumbra and delta spot configuration. AR3770 to the north of the previously mentioned regions also persists as a region with a delta spot, although the flare activity from this region has been generally more muted. AR3772 in the southeast has revealed a delta spot on one of its intermediate spots and remains highly active, giving the second largest flare of the period. AR3774 has continued to rotate into a better viewing position, and looks to be another large and magnetically complex region that will bear watching. AR3775 in the northeast has seen continued development in recent hours, growing in size and magnetic complexity, with a delta spot forming in its central portion.

A CME was observed from the southwest limb in association with an M7.4 flare from AR3768 at 02/0455UTC. This is awaiting analysis, but is expected to pass ahead of Earths orbit.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, was mostly at slightly elevated levels between 400-450km/s, under weak CME influence. Density was highly variable, generally around or below average, peaking briefly above average at 14ppcc. The Interplanetary Magnetic Field, Bt, was generally moderate, falling weak at times, between 2-12nT. The north-south component, Bz, was mostly positive, with some brief negative intervals from 02/0000UTC onwards, and ranged between -4 and +9nT. Phi angle was positive (away from the Sun). Geomagnetic activity was Quiet-Unsettled (Kp2-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels. The 24-hour fluence was below the Active threshold with 1.18e6 integrated pfu observed at 02/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares.

Solar Wind /Geomagnetic Activity: Weak CME effects are currently waning, with limited impact so far. Further CME arrivals are possible on Days 1-2 (02-03 Aug). They are both low confidence, but glancing blows are possible on both days. Furthermore, due to the number of

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

coincident CMEs, further arrivals cannot be ruled out through the period.

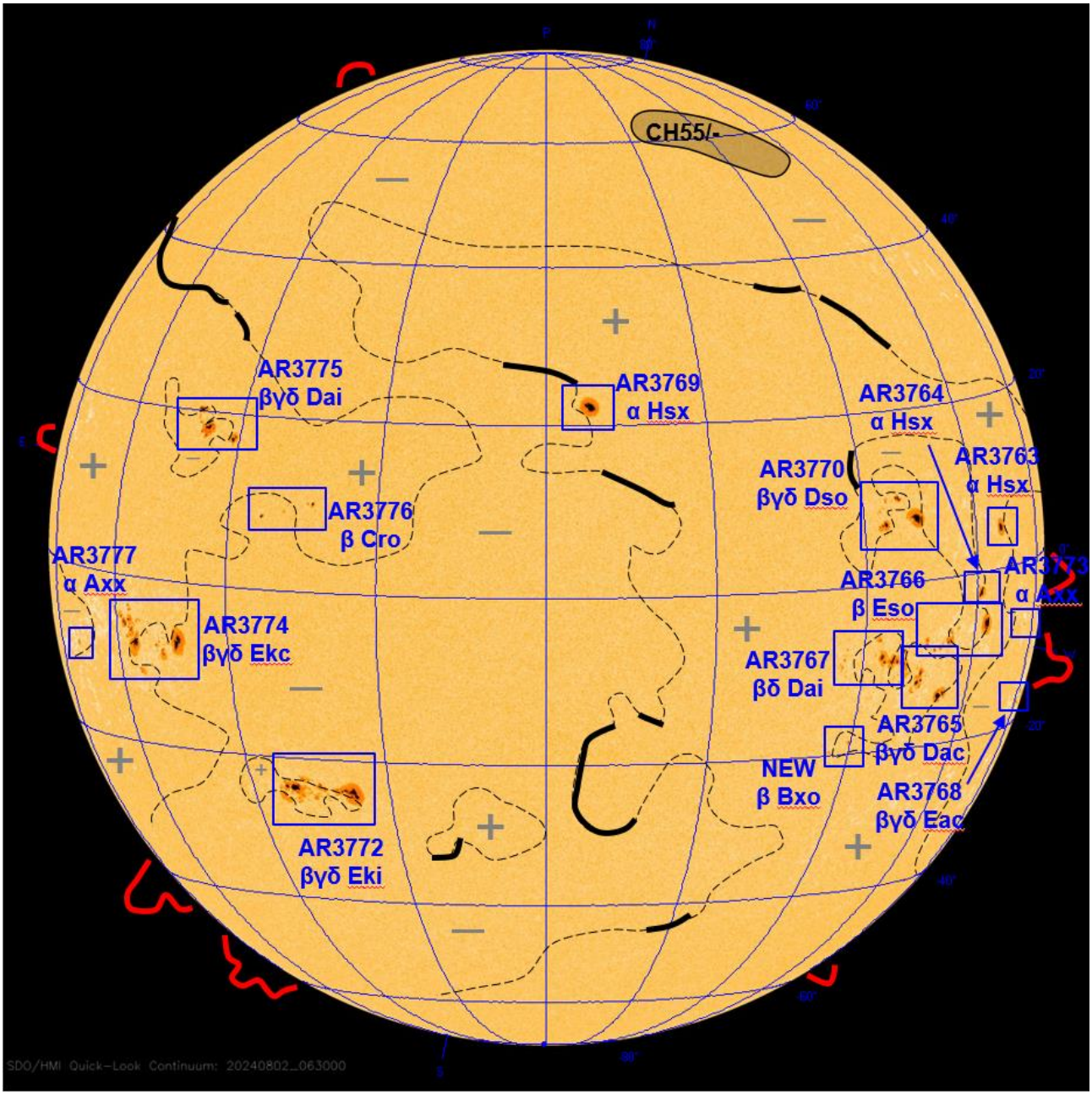
No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled, with periods of Active conditions possible and a persistent chance of G1-G2/Minor-Moderate Geomagnetic Storms should any CME arrivals bring more than a glancing blow. In the absence of further CME influence, activity is likely to become mostly Quiet later in the period.

Energetic Particles / Solar Radiation: High energy proton flux is currently at background levels. Should any notable flares occur in the western disk there is a chance of exceeding the S1/Minor Radiation Storm threshold. The high energy electron flux is forecast to be mostly at background levels, although moderate or perhaps high flux becoming possible at the diurnal peak on Days 2-4 (03-05 Aug). The associated 24-hour fluence is likely to remain below the Active threshold (1e8 integrated pfu), with a slight chance of exceeding by the end of the period.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1. Solar Analysis Valid 02/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Met Office Space Weather Technical Forecast

Geomagnetic Storms:
Earth is currently experiencing waning weak CME effects from CME arrivals over the past couple of days.

A further CME arrival is possible on Day 1 (02 Aug), with the chance of a glancing impact from a CME that left the Sun on the 30th July, although this is very low confidence. A second glancing CME blow is possible later on Day 2 (03 Aug), associated with a broad CME from the recent M8.2 flare at 01/0709UTC from AR3768. Analysis of this CME suggests a glancing blow could be possible, however a more direct blow remains a very slight possibility. Due to the large number of coincident CMEs in recent days, including those off the Earth-Sun line, analysis has been more difficult than usual. Consequently further arrivals cannot be ruled out through the period.

A CME was observed to the SW in association with a M7.4 flare from AR3768, peaking at 02/0455UTC. Associated Type II (438km/s) and Type IV radio emissions were recorded, as well as a 440sfu Tenflare. Analysis is awaiting, but it is expected that this CME will comfortably miss ahead of Earths orbit.

No coronal hole fast wind enhancements are expected during the period, with CME arrivals expected to be the main factor of interest. Geomagnetic activity is expected to be generally Quiet to Unsettled, with periods of Active conditions possible and a persistent chance of G1-G2/Minor-Moderate Geomagnetic Storms should any CME arrivals bring more than a glancing blow. In the absence of further CME influence, activity is likely to become mostly Quiet later in the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	25	30	30	25
Strong	G3	No	1	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

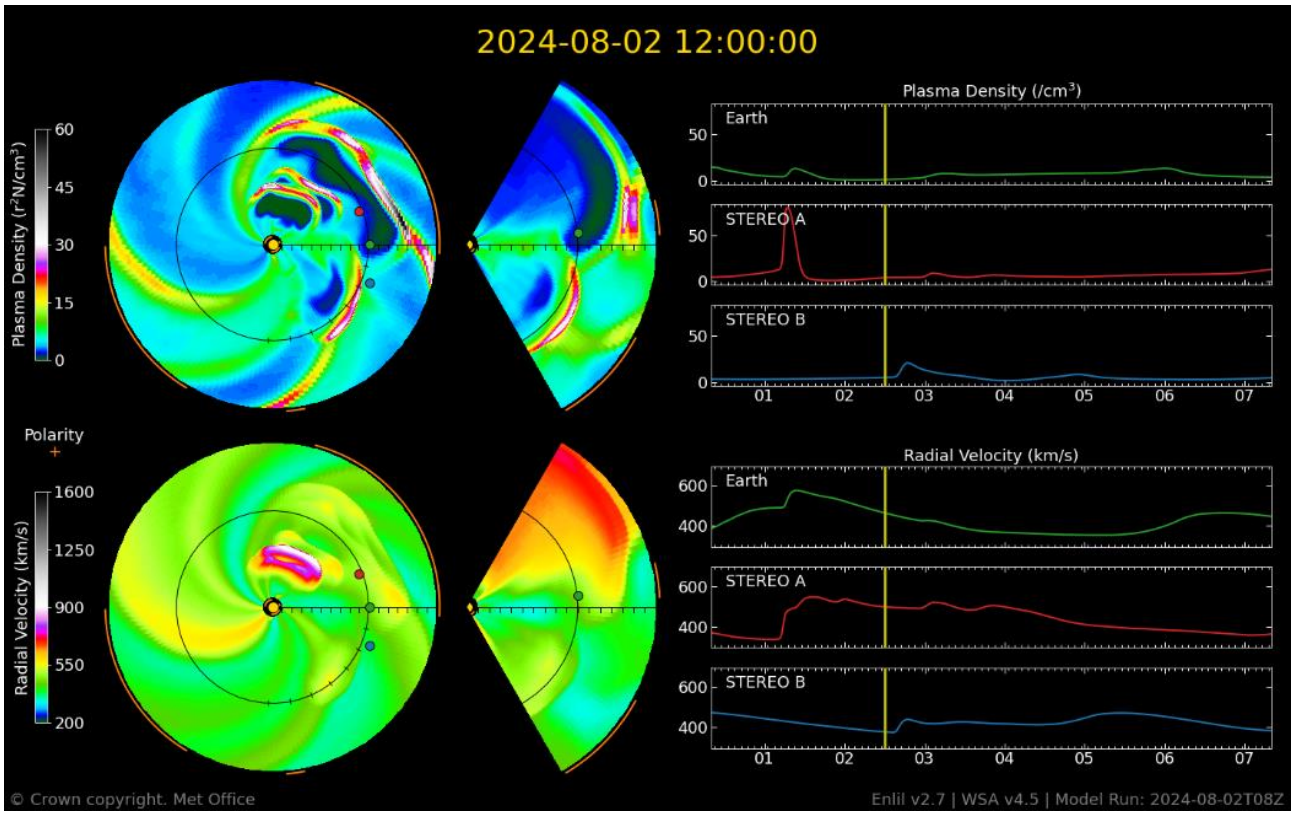
Geomagnetic Activity - Earthbound Coronal Mass Ejections

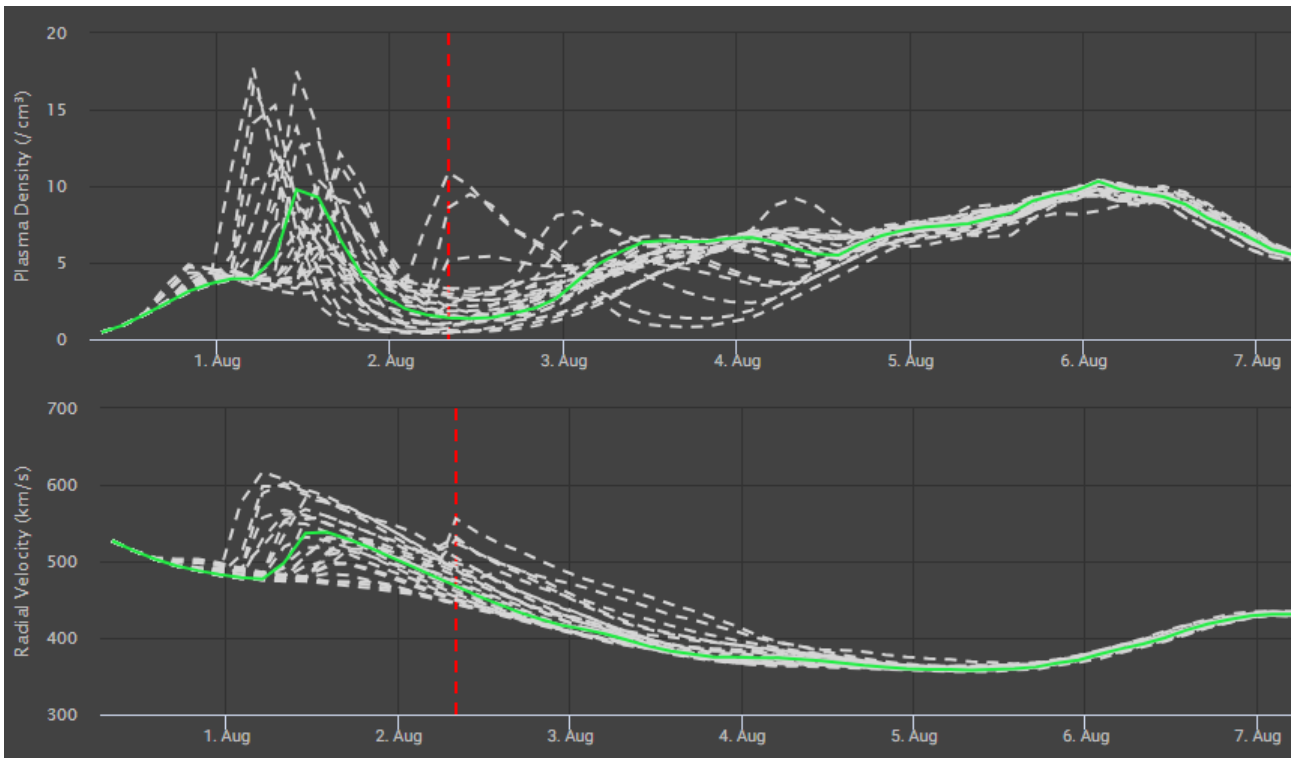
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
01/1053	Partial	M8.2 flare	SW limb	1148 km/s	Afternoon 03 Aug	Low confidence glancing blow

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: MOSWOC Enlil and ensemble models.





Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
A highly active disc with fifteen sunspot regions. AR3768 is currently rotating off the visible disc in the southwest, but continues to be active, providing the largest flare activity with an M7.4 peaking at 02/0455UTC. It is no longer visible enough to assess, but will likely continue to contribute to the flare risk well into Day 2 (03 Aug) as it rotates away. AR3765, AR3766 and AR3767 persist as a cluster of spots in the southwest disc, with AR3765 and AR3767 in particular in very close proximity, to the point where the two regions are pushed together with the trailing and leading portions sharing a penumbra and delta spot configuration. These regions flare risk only beginning to ease by the end of the period. AR3770 to the north of the previously mentioned regions also persists as a region with a delta spot, although the flare activity from this region has been generally more muted. AR3772 in the southeast has revealed a delta spot on one of its intermediate spots and remains highly active, giving the second largest flare of the period. AR3774 near the east limb is appearing to be another large and magnetically complex region, with the history of this region suggesting the potential for significant flare activity. AR3775 in the northeast has also shown recent growth, with a delta spot forming in its central portion.

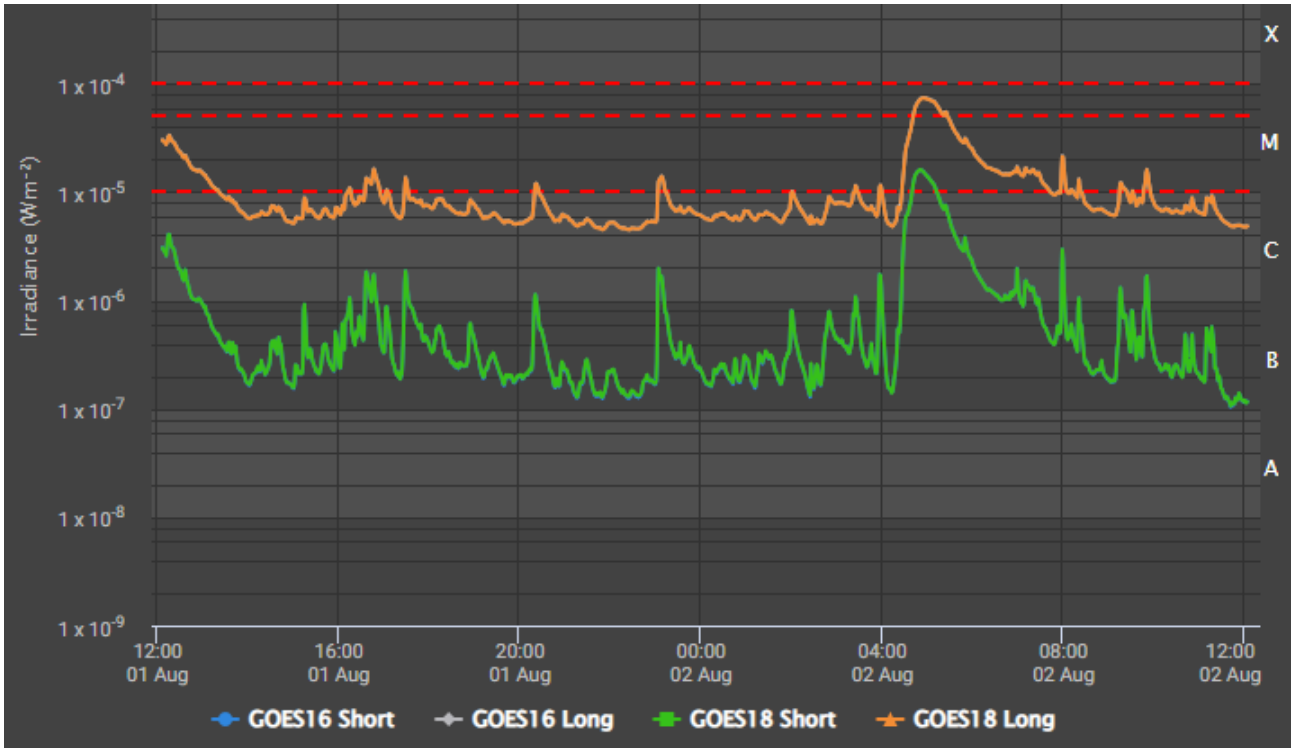
Far-side sounding data suggests the potential for at least one significant oncoming region by the end of this guidance period. Provisionally a slight drop in flare risk is suggested through Days 3-4 (03-04 Aug) as the cluster of active regions in the west begin to leave the disk, although oncoming regions could potentially balance this decline. Overall Moderate to High activity is forecast to continue, with occasional M-class flares expected and a chance of isolated X-class flares given the large number of complex active regions currently on the disk and activity over recent days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	90	90	80	70
Very Active	R3 to R5 X Class	No	30	30	25	20

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 3: GOES-16 and -18 X-ray flux



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as observed by GOES-18, is currently is currently at background levels but has the potential to rise in response to any notable flares on the disc, particularly those from the west of the disc and therefore in a favorable position to give proton enhancement from any significant flare activity. This brings a chance of reaching the S1/Minor Radiation Storm levels, reducing slightly by the end of the period as active regions in the west increasingly rotate away.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	30	30	25	20
Very Active	**≥ S3 ***	No	5	5	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

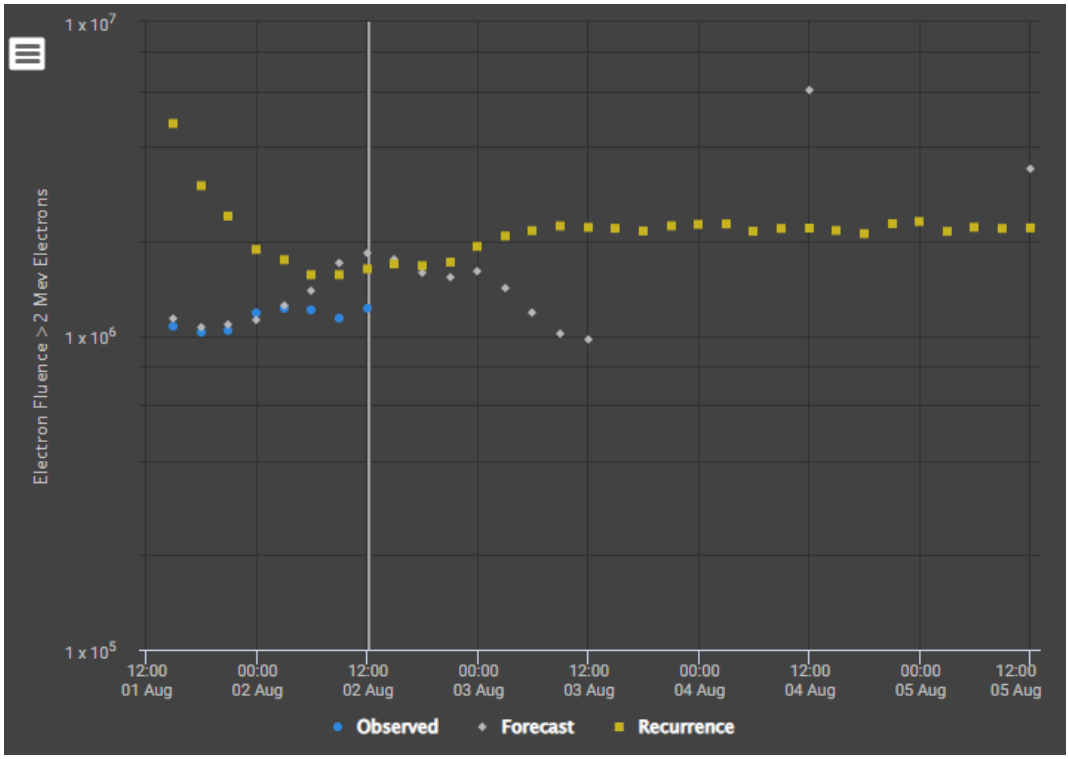
© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
High energy electron flux levels, as observed by GOES-16, is currently at background having been suppressed by recent CME arrivals. Further CME arrivals are likely to keep the observed flux near background levels in the short term, but recent CME activity is likely to have caused an increase in electron flux below GEO. Assuming CME influence wanes later in the period (an assumption where confidence is low), this will probably be reflected in an increase in electron flux later in the period, with moderate or perhaps high flux becoming possible at the diurnal peak on Days 2-4 (03-05 Aug).

The associated 24hr electron fluence is most likely to remain below Active (1e8 integrated pfu), although with the potential for a rising trend later in the period. There is a slight chance of exceeding Active by Day 4. MOSWOC REFM output suggests below Active through the period, which is reasonable, but confidence becomes increasingly low.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	15
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.